

Emissions of Greenhouse Gases in the United States 2005

Table 25. Estimated U.S. Emissions of Nitrous Oxide, 1990, 1995, and 1998-2005

Source	1990	1995	1998	1999	2000	2001	2002	2003	2004	P2005
Million Metric Tons Carbon Dioxide Equivalent										
Agriculture										
Nitrogen Fertilization of Soils	186.9	187.3	194.0	192.7	189.4	189.1	185.1	186.6	211.9	218.1
Solid Waste of Domesticated Animals . .	61.9	65.6	62.8	62.3	61.8	61.4	61.1	60.7	60.3	61.2
Crop Residue Burning	0.5	0.5	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.6
Subtotal	249.3	253.4	257.4	255.6	251.8	251.1	246.8	247.8	272.9	279.9
Energy Use										
Mobile Combustion	37.4	52.2	54.3	54.0	53.6	52.4	51.2	50.5	52.0	52.6
Stationary Combustion	13.3	13.9	14.4	14.6	15.0	14.5	14.3	14.5	14.8	14.7
Subtotal	50.8	66.1	68.7	68.6	68.6	66.9	65.6	65.0	66.9	67.3
Industrial Sources	28.6	32.9	17.2	16.8	16.6	14.0	15.2	14.0	14.0	13.2
Waste Management										
Human Sewage in Wastewater	4.6	5.1	5.3	5.5	5.6	5.6	5.7	5.7	5.8	5.8
Waste Combustion	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3
Subtotal	4.9	5.4	5.5	5.8	5.8	6.0	6.0	6.1	6.1	6.2
Total	333.5	357.7	348.8	346.8	342.8	337.9	333.6	332.9	359.9	366.6
Thousand Metric Tons Nitrous Oxide										
Agriculture										
Nitrogen Fertilization of Soils	631	633	655	651	640	639	625	630	716	737
Solid Waste of Domesticated Animals . .	209	222	212	211	209	207	207	205	204	207
Crop Residue Burning	2	2	2	2	2	2	2	2	2	2
Subtotal	842	856	869	864	851	848	834	837	922	946
Energy Use										
Mobile Combustion	126	176	183	183	181	177	173	170	176	178
Stationary Combustion	45	47	49	49	51	49	48	49	50	50
Subtotal	172	223	232	232	232	226	222	220	226	227
Industrial Sources	96	111	58	57	56	47	51	47	47	45
Waste Management										
Human Sewage in Wastewater	16	17	18	19	19	19	19	19	20	20
Waste Combustion	1	1	1	1	1	1	1	1	1	1
Subtotal	17	18	19	20	20	20	20	20	21	21
Total	1,127	1,208	1,178	1,172	1,158	1,141	1,127	1,125	1,216	1,238

P = preliminary data.

Notes: Data in this table are revised from the data contained in the previous EIA report, *Emissions of Greenhouse Gases in the United States 2004*, DOE/EIA-0573(2004) (Washington, DC, December 2005). Totals may not equal sum of components due to independent rounding.

Sources: Estimates presented in this chapter. Emissions calculations based on Intergovernmental Panel on Climate Change, *Greenhouse Gas Inventory Reference Manual: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, Vol. 3 (Paris, France, 1997), pp. 4.81-4.94, web site www.ipcc.ch/pub/guide.htm; and U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004*, EPA-430-R-06-002 (Washington, DC, April 2006), web site <http://yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterPublicationsGHGEmissionsUSEmissionsInventory2006.html>.

Table 26. U.S. Nitrous Oxide Emissions from Nitrogen Fertilization of Agricultural Soils, 1990, 1995, and 1998-2005

Source	1990	1995	1998	1999	2000	2001	2002	2003	2004	P2005
Million Metric Tons Carbon Dioxide Equivalent										
Direct Emissions										
Biological Fixation in Crops	58.6	62.1	68.7	68.2	67.9	69.5	65.3	62.5	71.0	70.7
Nitrogen Fertilizers	53.1	51.2	47.5	47.7	45.6	44.4	45.6	48.0	54.3	58.6
Crop Residues	28.2	28.1	34.8	33.8	34.6	34.7	32.9	32.8	38.5	37.3
Soil Mineralization	3.0	3.1	3.1	3.1	3.1	3.1	3.1	3.2	3.2	3.2
Animal Manure	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Sewage Sludge	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.4	0.4
Total Direct Emissions	144.1	145.9	155.5	154.1	152.4	153.0	148.2	147.7	168.2	171.0
Indirect Emissions										
Soil Leaching	36.3	35.2	32.6	32.8	31.3	30.6	31.4	33.0	37.1	40.0
Atmospheric Deposition	6.5	6.3	5.8	5.8	5.6	5.5	5.6	5.9	6.6	7.1
Total Indirect Emissions	42.8	41.4	38.5	38.6	36.9	36.0	37.0	38.8	43.7	47.1
Total	186.9	187.3	194.0	192.7	189.4	189.1	185.1	186.6	211.9	218.1
Thousand Metric Tons Nitrous Oxide										
Direct Emissions										
Biological Fixation in Crops	198	210	232	230	229	235	221	211	240	239
Nitrogen Fertilizers	179	173	161	161	154	150	154	162	183	198
Crop Residues	95	95	118	114	117	117	111	111	130	126
Soil Mineralization	10	10	10	10	11	11	11	11	11	11
Animal Manure	4	5	4	4	4	4	4	4	4	4
Sewage Sludge	1	1	1	1	1	1	1	1	1	1
Total Direct Emissions	487	493	525	521	515	517	501	499	568	578
Indirect Emissions										
Soil Leaching	123	119	110	111	106	103	106	111	125	135
Atmospheric Deposition	22	21	20	20	19	18	19	20	22	24
Total Indirect Emissions	144	140	130	130	125	122	125	131	148	159
Total	631	633	655	651	640	639	625	630	716	737

P = preliminary data.

Notes: Data in this table are revised from the data contained in the previous EIA report, *Emissions of Greenhouse Gases in the United States 2004*, DOE/EIA-0573(2004) (Washington, DC, December 2005). Totals may not equal sum of components due to independent rounding.

Sources: Estimates presented in this chapter. Emissions coefficients from Intergovernmental Panel on Climate Change, *Greenhouse Gas Inventory Reference Manual: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, Vol. 3 (Paris, France, 1997), pp. 4.89-4.107, web site www.ipcc.ch/pub/guide.htm. Total nitrogen content of U.S. commercial fertilizer consumption—1988-1994, Tennessee Valley Authority; 1995-2002, Association of American Plant Food Control Officials, *Commercial Fertilizers* (Washington, DC, various years). Manure application based on cattle population data provided by the U.S. Department of Agriculture, National Agricultural Statistics Service, web sites www.usda.gov/nass/pubs/histdata.htm and www.nass.usda.gov/ipedb/. Typical animal sizes from U.S. Environmental Protection Agency, Office of Air and Radiation, *Anthropogenic Methane Emissions in the United States: Estimates for 1990* (Washington, DC, April 1993), p. 6-8. Manure production and waste management systems used from L.M. Safley, M.E. Casada et al., *Global Methane Emissions From Livestock and Poultry Manure* (Washington, DC, February 1992), and U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004*, EPA-430-R-06-002 (Washington, DC, April 2006), web site <http://yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterPublicationsGHGEmissionsUS EmissionsInventory2006.html>.

Table 27. U.S. Nitrous Oxide Emissions from Solid Waste of Domesticated Animals, 1990, 1995, and 1998-2005

Source	1990	1995	1998	1999	2000	2001	2002	2003	2004	P2005
Million Metric Tons Carbon Dioxide Equivalent										
Cattle.....	57.5	61.1	58.3	57.9	57.4	56.9	56.7	56.3	55.8	56.4
Swine.....	1.5	1.6	1.7	1.6	1.6	1.6	1.6	1.7	1.7	1.7
Poultry.....	0.9	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4
Horses.....	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Sheep.....	1.0	0.8	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5
Goats.....	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4
Total.....	61.9	65.6	62.8	62.3	61.8	61.4	61.1	60.7	60.3	61.2
Thousand Metric Tons Nitrous Oxide										
Cattle.....	194	206	197	195	194	192	192	190	189	191
Swine.....	5	5	6	6	5	6	6	6	6	6
Poultry.....	3	4	4	4	4	4	4	4	5	5
Horses.....	2	2	2	2	2	2	2	2	2	2
Sheep.....	3	3	2	2	2	2	2	2	2	2
Goats.....	1	1	1	1	1	1	1	1	1	1
Total.....	209	222	212	211	209	207	207	205	204	207

P = preliminary data.

Note: Totals may not equal sum of components due to independent rounding.

Sources: Estimates presented in this chapter. Nitrogen content of waste by species, manure management systems, and emissions coefficients from Intergovernmental Panel on Climate Change, *Greenhouse Gas Inventory Reference Manual: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, Vol. 3 (Paris, France, 1997), pp. 4.89-4.107. web site www.ipcc.ch/pub/guide.htm. Population data for horses and goats extrapolated from U.S. Department of Commerce, Bureau of the Census, *Census of Agriculture* (1982, 1987, 1992, and 1997). All other animal populations from U.S. Department of Agriculture, National Agricultural Statistics Service, web sites www.usda.gov/nass/pubs/histdata.htm and www.nass.usda.gov/ipeddb/. Typical animal sizes from U.S. Environmental Protection Agency, Office of Air and Radiation, *Anthropogenic Methane Emissions in the United States: Estimates for 1990* (Washington, DC, April 1993), p. 6-8. Cattle sizes adjusted by annual slaughter weight from U.S. Department of Agriculture, National Agricultural Statistics Service.

Table 28. U.S. Nitrous Oxide Emissions from Mobile Combustion, 1990, 1995, and 1998-2005

Item	1990	1995	1998	1999	2000	2001	2002	2003	2004	P2005
Million Metric Tons Carbon Dioxide Equivalent										
Motor Vehicles										
Passenger Cars	21.6	29.2	29.3	28.9	28.3	27.4	26.1	25.1	25.0	24.5
Light-Duty Trucks	10.4	17.2	19.0	18.9	18.9	18.8	18.9	19.2	20.5	21.2
Other Trucks	1.7	2.1	2.3	2.4	2.4	2.5	2.6	2.6	2.7	2.7
Buses	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Motorcycles	*	*	*	*	*	*	*	*	*	*
Subtotal	33.9	48.6	50.7	50.3	49.7	48.8	47.7	47.1	48.3	48.5
Other Mobile Sources	3.6	3.6	3.5	3.7	3.9	3.6	3.6	3.4	3.7	4.1
Total	37.4	52.2	54.3	54.0	53.6	52.4	51.2	50.5	52.0	52.6
Thousand Metric Tons Nitrous Oxide										
Motor Vehicles										
Passenger Cars	73	98	99	98	96	92	88	85	85	83
Light-Duty Trucks	*	*	*	*	*	*	*	*	*	*
Other Trucks	*	*	*	*	*	*	*	*	*	*
Buses	35	58	64	64	64	64	64	65	69	72
Motorcycles	6	7	8	8	8	8	9	9	9	9
Subtotal	114	164	171	170	168	165	161	159	163	164
Other Mobile Sources	12	12	12	12	13	12	12	11	13	14
Total	126	176	183	183	181	177	173	170	176	178

*Less than 50,000 metric tons carbon dioxide equivalent or less than 500 metric tons nitrous oxide.

P = preliminary data.

Notes: Data in this table are revised from the data contained in the previous EIA report, *Emissions of Greenhouse Gases in the United States 2004*, DOE/EIA-0573(2004) (Washington, DC, December 2005). Totals may not equal sum of components due to independent rounding.

Sources: Calculations based on vehicle miles traveled from U.S. Department of Transportation, *Federal Highway Statistics* (various years), Table VM-1, and current year preliminary estimates calculated using growth rates from EIA, *Short-Term Energy Outlook* (various years). Other Mobile Sources calculations based on Oak Ridge National Laboratory, *Transportation Energy Data Book*; EIA, *Fuel Oil and Kerosene Sales, State Energy Data Report*, and *Petroleum Supply Annual* (various years). Passenger car and light-duty truck emissions coefficients from U.S. Environmental Protection Agency, Office of Air and Radiation, *Emissions of Nitrous Oxide From Highway Mobile Sources: Comments on the Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-1996*, EPA-420-R-98-009 (Washington DC, August 1998). Emissions coefficients from Intergovernmental Panel on Climate Change, *Greenhouse Gas Inventory Reference Manual: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, Vol. 3 (Paris, France, 1997), pp. 1.64-1.68, web site www.ipcc.ch/publ/guide.htm.

Table 29. U.S. Nitrous Oxide Emissions from Stationary Combustion, 1990, 1995, and 1998-2005

Source	1990	1995	1998	1999	2000	2001	2002	2003	2004	P2005
Thousand Metric Tons Carbon Dioxide Equivalent										
Residential										
Coal	13	7	5	6	4	5	5	5	6	5
Fuel Oil ^a	251	247	235	263	279	275	261	268	277	274
Natural Gas	128	142	133	138	145	139	143	149	143	142
Wood	676	606	443	466	501	431	443	466	478	489
Total	1,068	1,002	815	873	929	850	852	888	903	911
Commercial										
Coal	52	48	42	42	36	38	38	34	42	42
Fuel Oil ^a	170	131	118	118	135	132	122	134	135	138
Natural Gas	77	89	88	89	92	89	92	93	92	89
Wood	77	84	75	78	83	78	80	83	82	82
Total	375	352	323	328	346	337	332	344	351	351
Industrial										
Coal	1,129	1,020	925	905	940	913	841	851	853	818
Fuel Oil ^a	1,606	1,668	1,680	1,743	1,690	1,694	1,644	1,655	1,750	1,701
Natural Gas	242	274	279	268	271	248	252	243	244	224
Wood	1,680	1,924	1,867	1,887	1,906	1,681	1,626	1,588	1,719	1,442
Total	4,657	4,886	4,752	4,803	4,807	4,536	4,363	4,336	4,566	4,185
Electric Power										
Coal	6,770	7,278	8,008	8,034	8,426	8,205	8,244	8,411	8,446	8,635
Fuel Oil ^a	228	135	233	216	204	229	216	215	213	216
Natural Gas	94	123	133	140	151	153	164	150	156	165
Wood	150	146	160	161	156	147	175	195	192	196
Total	7,242	7,682	8,534	8,551	8,937	8,733	8,799	8,971	9,008	9,212
Total All Sectors										
Coal	7,963	8,354	8,980	8,987	9,406	9,161	9,128	9,301	9,347	9,501
Fuel Oil ^a	2,256	2,180	2,266	2,341	2,308	2,330	2,242	2,272	2,375	2,329
Natural Gas	541	627	633	634	659	629	651	635	634	621
Wood	2,583	2,760	2,544	2,592	2,646	2,337	2,324	2,331	2,471	2,209
Total	13,343	13,921	14,424	14,554	15,020	14,457	14,346	14,539	14,827	14,659

^aFuel oil use in the residential sector consists of distillate fuel only. In the other sectors it includes both distillate and residual fuel oil.

P = preliminary data. See notes and sources at end of table.

Table 29. U.S. Nitrous Oxide Emissions from Stationary Combustion, 1990, 1995, and 1998-2005 (Continued)

Source	1990	1995	1998	1999	2000	2001	2002	2003	2004	P2005
Thousand Metric Tons Nitrous Oxide										
Residential										
Coal	*	*	*	*	*	*	*	*	*	*
Fuel Oil ^a	1	1	1	1	1	1	1	1	1	1
Natural Gas	*	*	*	*	*	*	*	1	*	*
Wood	2	2	1	2	2	1	1	2	2	2
Subtotal	4	3								
Commercial										
Coal	*	*	*	*	*	*	*	*	*	*
Fuel Oil ^a	1	*	*	*	*	*	*	*	*	*
Natural Gas	*	*	*	*	*	*	*	*	*	*
Wood	*	*	*	*	*	*	*	*	*	*
Subtotal	1									
Industrial										
Coal	4	3	3	3	3	3	3	3	3	3
Fuel Oil ^a	5	6	6	6	6	6	6	6	6	6
Natural Gas	1	1	1	1	1	1	1	1	1	1
Wood	6	7	6	6	6	6	5	5	6	5
Subtotal	16	17	16	16	16	15	15	15	15	14
Electric Power										
Coal	23	25	27	27	28	28	28	28	29	29
Fuel Oil ^a	1	*	1	1	1	1	1	1	1	1
Natural Gas	*	*	*	*	1	1	1	1	1	1
Wood	1	*	1	1	1	*	1	1	1	1
Total	24	26	29	29	30	30	30	30	30	31
Total All Sectors										
Coal	27	28	30	30	32	31	31	31	32	32
Fuel Oil ^a	8	7	8	8	8	8	8	8	8	8
Natural Gas	2	2	2	2	2	2	2	2	2	2
Wood	9	9	9	9	9	8	8	8	8	7
Total	45	47	49	49	51	49	48	49	50	50

^aFuel oil use in the residential sector consists of distillate fuel only. In the other sectors it includes both distillate and residual fuel oil.

*Less than 500 metric tons nitrous oxide.

P = preliminary data.

Notes: Data in this table are revised from the data contained in the previous EIA report, *Emissions of Greenhouse Gases in the United States 2004*, DOE/EIA-0573(2004) (Washington, DC, December 2005). Totals may not equal sum of components due to independent rounding.

Sources: Emissions coefficients from Intergovernmental Panel on Climate Change, *Greenhouse Gas Inventory Reference Manual: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, Vol. 3 (Paris, France, 1997), p. 1.50, web site www.ipcc.ch/pub/guide.htm. Energy consumption data from Energy Information Administration, *State Energy Data Report 1998*, DOE/EIA-0214(98) (Washington, DC, September 2003); and *Monthly Energy Review*, DOE/EIA-0035(2003/08) (Washington, DC, August 2003).

Table 30. U.S. Nitrous Oxide Emissions from Industrial Sources, 1990, 1995, and 1998-2005

Source	1990	1995	1998	1999	2000	2001	2002	2003	2004	P2005
Million Metric Tons Carbon Dioxide Equivalent										
Adipic Acid										
Controlled Sources	1.0	1.1	1.5	1.5	1.6	1.4	1.6	1.6	1.6	1.6
Uncontrolled Sources	15.9	18.7	2.0	2.1	2.1	2.1	2.3	1.4	1.4	1.4
Subtotal	16.8	19.8	3.5	3.6	3.7	3.5	3.9	3.0	3.1	2.9
Nitric Acid.....	11.7	13.1	13.7	13.2	12.9	10.4	11.3	11.0	10.9	10.3
Total Known Industrial Sources....	28.6	32.9	17.2	16.8	16.6	14.0	15.2	14.0	14.0	13.2
Thousand Metric Tons Nitrous Oxide										
Adipic Acid										
Controlled Sources	3	4	5	5	5	5	5	5	6	5
Uncontrolled Sources	54	63	7	7	7	7	8	5	5	5
Subtotal	57	67	12	12	13	12	13	10	10	10
Nitric Acid.....	40	44	46	45	43	35	38	37	37	35
Total Known Industrial Sources....	96	111	58	57	56	47	51	47	47	45

P = preliminary data.

Note: Data in this table are revised from the data contained in the previous EIA report, *Emissions of Greenhouse Gases in the United States 2004*, DOE/EIA-0573(2004) (Washington, DC, December 2005). Totals may not equal sum of components due to independent rounding.

Sources: Data sources and methods documented in Energy Information Administration, *Documentation for Emissions of Greenhouse Gases in the United States 2004*, DOE/EIA-0638(2004) (Washington, DC, November 2006), and *Documentation for Emissions of Greenhouse Gases in the United States 2005*, DOE/EIA-0638(2005) (to be published).